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Processing device

The invention relates to a processing device with a laser beam generator as a tool. High-energy laser radiation is used for burning, welding, perforating and other operations. In widespread use for example are inscription devices, with which data important for the user, but also for example the designation of the manufacturer, are burned into workpieces such as twist drills, shank-end mills and the like by means of the laser beam. For this purpose, the laser beam is deflected in two directions, for example by means of two low-inertia plane mirrors, while the workpiece is stationary. In order that tolerances of the mirror surfaces have only minor effects and also in order that the mirrors themselves are not damaged by the laser beam, the beam cross section is initially widened and then directed parallel again, then impinges on the mirrors (or prisms) and is then made convergent again by means of focusing optics, in order to form a focal point of high-energy density in the inscription plane.

Such inscription devices have advantages over the previously customary etching methods. For instance, there is no longer the necessity for pre-treatment (degreasing) and post-treatment (neutralizing, greasing). In addition, laser inscription is a very fast procedure, it being possible for the changing over of the inscription text to be carried out very easily by means of a keyboard for example.

In the case of commercially available laser inscription devices, the direction of the rays in the region behind the focusing optics is arranged such that it runs vertically downwards. The actual working area is surrounded by a protective shroud, in order that the operator cannot be hit by stray radiation. With the

protective shroud closed, the inscription of one or more workpieces takes place in a time period which is typically of the order of magnitude of a few seconds. After that, with the protective shroud open, the operator removes the inscribed workpieces and places new blanks into a receiving device, which positions the inscription area into the focal plane of the beam. These known devices accordingly have the features which are stated in the precharacterizing clause of Claim 1.

The time requirement for the removal of the inscribed workpieces and the placement of the blank workpieces is often of the same order of magnitude as that for the actual inscription; often the inscription operation is even many times shorter than this setting-up time. Thus, the high investments for the beam generator and its optics are used only poorly.

The object of the invention is to develop the device of this generic type in such a way that the overall duration of the operation is shortened, so that better use is made of the investments.

The solution provided according to the invention for achieving this object emerges from Claim 1; the subclaims define the configuration for the case in which the setting-up time and inscription time are approximately of the same length.

It will be appreciated that the laser beam performs inscriptions (or other recurring operations) in time-division multiplexing mode at a number of locations, the operator using the operating period of the laser to load the then respectively unused working place. The time requirement for the optical switching over of the beam is in this case negligible, and the constructional expenditure is low.

An exemplary embodiment of the subject-matter of the invention is explained in more detail below with reference to the attached drawing, which shows a device according to the invention in a largely schematized way.

The drawing depicts the laser beam generator 1, the construction of which is known and is not the subject of the invention. The beam passes through expansion optics 2, comprising a biconcave lens and a biconvex lens, behind which the beam is expanded to form a bundle of essentially parallel individual rays; in the drawing, the limitations of the bundle are depicted. The bundle of rays then impinges on a first mirror 3, which is positionally controllable in a single axis, and runs from this mirror to a second mirror 4, which can be pivoted in a controlled manner about an axis running perpendicular to the axis of the first mirror. By activating drives (not shown) for the mirrors 3, 4 with corresponding signals, the bundle of rays is deflected in two mutually perpendicular directions, which run essentially perpendicular to the beam axis, before the bundle of rays is concentrated in a focal point by means of focusing optics 6. To this extent, the device is known.

According to the invention, switch-over optics, comprising a switch-over prism 5 with a pivot axis 10, is inserted between the mirror 4 and the focusing optics 6. In the position drawn, the bundle of rays is totally reflected by the switch-over prism 5 and deflected by 90°. It then impinges on a stationary prism 8, which likewise totally reflects the bundle of rays and deflects it onto the focusing optics 6.

The switch-over prism 5 is pivotable back and forth about the axis 10 by 90° in each case, to be precise from the position drawn in the clockwise direction and from the position then assumed back again into the

position drawn. In the position not drawn, the bundle of rays is directed at a second stationary prism 9, which directs the bundle onto second focusing optics 7. The distance between the optical axes "A" should have an ergonomically favourable value between 20 and 100 cm, preferably between 40 and 60 cm.

It goes without saying that plane mirrors can be used instead of one or more of the prisms, or that the prisms 8, 9 can be replaced by focusing mirrors, in which case the additional focusing optics 6 and 7 could be omitted.

It also goes without saying that, depending on the setting-up time/processing time ratio, more than two working places can be assigned to the one beam generator.

Claims

1. Processing device with a laser beam generator (1) and with optics for influencing the beam arranged in the path of rays of the laser beam, comprising beam-expansion optics (2), behind which the beam runs through a first region, in which it has negligible divergence or convergence, positionally controllable mirrors (3, 4), arranged in the first region for deflecting the laser beam, and focusing optics, behind which the beam converges to a working focal point in a second region, characterized in that at least one set of controllable switch-over optics (5), which directs the beam optionally to one of a plurality of focusing optics (6, 7) is provided in the first region, in front of the focusing optics.

2. Device according to Claim 1, characterized in that the switch-over optics comprise a totally reflecting switch-over prism (5), which is arranged in the first region and can be tilted back and forth by 90° about an axis parallel to its edges, and in that each position of the prism is assigned one of two sets of focusing optics (6, 7).

3. Device according to Claim 2, characterized in that the optical axes of the focusing optics (6, 7) are parallel and each set of focusing optics is preceded by a further totally reflecting, stationary prism (8, 9).

4. Device according to Claim 3, characterized by a distance between the two optical axes in the range between 20 and 100 cm, preferably 40..60 cm.